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ABSTRACT
                A Virtual Research and Extension Communication Network
(VRECN) is a set of networked electronic tools facilitating improvement in
communication processes and information sharing among stakeholders involved
in agricultural development. In developing countries, research and extension
personnel within a ministry of agriculture, in consultation and collaboration
with key stakeholders, can develop and implement a VRECN. The tools are
artifacts of a planned and ongoing process of stakeholder involvement in
mapping communication- and information-sharing relationships and identifying
critical relationships that require improvement to reach agricultural
development and food security goals. Creating a VRECN in a developing country
requires a planned process of stakeholder engagement, multi-stakeholder
assessments of communication and information needs, and collaborative
workshops to determine the desired characteristics of a VRECN, management
relationships, and development partnerships. Six steps are to conduct project
preparation, information technology assessment, and VRECN prototype
development; identify product and services for VRECN; create VRECN prototype
and directory; evaluate product and services; identify and secure staff
support; and evaluate project. A number of tangible products result from a
preplanned process for creating a VRECN, particularly through efforts to
establish stakeholder needs assessments and collaborative working groups.
(YLB)

Concept Paper for the

Food & Agriculture Organisation of

the United Nations (FAO)

The Virtual Research and Extension Communication Network

(VRECN)

An Interactive

Learning and Communication Network for

Research and Extension Personnel

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The Virtual Research and Extension Communication Network:

An Interactive Learning and Communication Network for Research and Extension Personnel

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1.0 Executive Summary

This concept paper describes a suite of networked electronic tools that can facilitate improvement in communication processes and information sharing among stakeholders involved in agricultural development. The suite of tools is described as a "Virtual Research and Extension Communication Network" (VRECN): an electronic communication network and set of learning tools that will be collaboratively developed and implemented by research and extension personnel within a Ministry of Agriculture, in consultation and collaboration with key stakeholders. The suite of tools are themselves artifacts of a planned and on-going process of stakeholder involvement in mapping communication and information sharing relationships and identifying critical relationships that require improvement in order to reach agricultural development and food security goals. The result of an effective VRECN will be research and extension personnel who are able to strategically collaborate in order to meet the challenges of agricultural development, in partnership with other stakeholders.

2. Purpose of the Concept Paper

In describing concept of a Virtual Research and Extension Communication Network, the paper addresses the following:

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- Collaborative electronic media learning tools relevant to complex agricultural systems
- Collaborative information and communication networks in agriculture today
- Multi-stakeholder approach to designing information and communication networks and learning tools
- Learning strategies and media applications that could be incorporated in the Virtual Research and Extension Communication Network
- The benefit that farmers will gain from the enhanced tools and the means that would enable them to become co-owners and active partners in the process of creating and managing a VRECN
- Virtual Research and Extension Communication Network integration within the organizational and policy framework of a Ministry of Agriculture's current agricultural knowledge and information system.
- The potential for linkage activities with various bodies of a national Ministry of Agriculture

The Concept paper describes a Virtual Research and Extension Communication Network that includes collaborative learning tools that reinforce the benefit of information sharing and communication in the generation of knowledge that enhances agricultural sustainability and food security.

The Concept paper describes a multi-stakeholder methodology for establishing a national Virtual Research and Extension Communication Network that is operated and managed by a diverse group of national Ministry of Agriculture agencies and staff members. The methodology involves a variety of planned collaborative workshop and consultation processes. Such a methodology is critical for insuring that the content of the VRECN, and the processes for selecting, managing and disseminating that content, are relevant to the needs of users and beneficiaries at all levels of the system: from the farmer to the Minister.

Anyone can create and manage a suite of electronic tools that *might* be used by agricultural stakeholders. Only stakeholders themselves can create and manage a suite of tools that *will* be used to enhance agricultural sustainability and food security. Stakeholder ownership and management of a VRECN is a key outcome that requires careful planning and partnership development.

3.0 What is a Virtual Research and Extension Communication Network?

Various manifestations of VRECNs exist in developed countries and are emerging in developing countries. They include, but are not limited to:

- dynamic information, communication and learning tools, such as World Wide Web databases, electronic mail networks, electronic newsletters and bulletins, and distance education programs that are facilitated via the Internet and telecommunication networks
- applications of voice telephone systems for communication and information sharing tools that provide agricultural information hotlines and research directories
- creative marriages between Internet tools and other media such as rural radio and print media
- linkages between electronic media and face-to-face workshops, discussion forums, and

"kitchen table" meetings
- geographically distributed video and audio conferencing systems via telecommunication networks and satellite systems
- publicly accessible geographic information system tools
- linkages with community communication centres and community organizations for improved information dissemination and feedback.

In developed countries, agricultural stakeholders are only beginning to recognize the existence of VRECNs. This recognition is partly the result of the convergence of digital electronic tools, computers and telecommunication systems. It is also partly the result of at least a decade of experimentation, prototyping and establishment of a wide variety of individual tools maintained by different organizations that work with essentially the same general client group of agricultural stakeholders. Recognition of the existence of a Virtual Research and Extension Communication Network emerges as people begin to recognize synergies between separate electronic tools and the ways in which users make use the Internet to create their own hybrid systems of useful tools.

Developed countries have a legacy of single-purpose agricultural software tools and limited-access agricultural networks. Prior to 1990, the Internet was largely outside of the realm of agriculture. Communication among agricultural stakeholders involved in creating and managing electronic tools was thus quite limited. Electronic tools tended to be geographically limited, or used by a select group of subject-matter specialists. The explosive growth of the Internet during the 1990's stimulated an intense period of collaboration, linkage, standardization, and development of "distributed" applications that can essentially be used by anyone connected to the Internet, anywhere and at any time.

During the latter years of the 1990's the "distributed," multi-user nature of these new applications catalyzed the development of tools (particularly Internet database tools) were not simply limited to "distributed" *use*. This latest generation of networked electronic tools could also be *developed, enhanced and collaboratively managed* by people who might work across time zones around the world: people who might never meet face-to-face.

While individual tools may be maintained by different organizations, users can mix and match whichever tools meet their specific needs. If their needs are not met, they have the option of creating their own tools and adding them to the network of tools available to all. Planned or happen-stance consultation among users helps to identify imperatives for linking these tools, ways of reducing duplication of services and ways of creating partnerships among organizations offering the tools. In Canada, for example, agricultural stakeholders have begun to take stock of the variety of networked electronic tools available. Canadian agriculture's honeymoon with "electronic technology for technology's sake" is over, and there is much greater interest in realistic and practical applications of information and communication technologies (ICTs) to meet pressing needs. Decreasing government funding for agricultural research and extension is one key factor driving this interest in practical tools that are individually supported by one organization, but accessible to all.

Organizations providing the tools in Canada are now meeting with one another, and with client groups, in order to provide better value and better information, improve communication relationships, and create synergistic partnerships among tool providers. Thus, we are seeing new and interesting strategic alliances between telephone system operators, agricultural ministries, rural development organizations, agricultural businesses, universities, farmer organizations, Internet service providers, and marketing organizations. Each organization

takes responsibility for supporting the components of the VRECN that best fit that organization's capabilities.

For example, the central directory of Canadian agricultural information on the Internet, the "Canadian Agriculture, Farm and Food Extension Information Network and Exchange" (CAFFEINE: http://www.caffeine.ca), was once maintained by the University of Guelph. University budgetary cuts and increasing management time for maintaining a rapidly growing database resulted in a strategic alliance with a private sector agriculture consulting firm specializing in Internet applications. CAFFEINE is now maintained by this firm and is funded through agricultural organizations and agri-businesses that place advertisements on the system. This funding base enabled the firm to update CAFFEINE into a sophisticated, dynamic and timely Internet database that includes automatic weekly updates sent to 300 subscribers, and replication in printed form as a bi-yearly directory of Canadian agricultural entities and services. On-going consultation with government, the private sector, agricultural organizations and CAFFEINE users enables the system to meet new goals and objectives as they emerge.

Today a user can link to CAFFEINE on the World Wide Web and instantly access information about market prices, weather, agricultural research, extension services, government programs, inputs and agricultural news. This information is separately maintained by hundreds of individual organizations. CAFFEINE also includes a vast "Chat" section through which users can discuss any topic they wish, a free classified advertising section for users to buy and sell things from one another, and a calendar database through which organizations can post information about upcoming events occurring throughout the country. CAFFEINE also contains a sub-set database for each Canadian province, with links to specialized chat forums, calendars, databases, and links to all agricultural entities using the Internet.

Creative marriages to other media are exemplified by the "Ontario AgRadio Network" (http://www.ciaccess.com/~agradio/) in the Province of Ontario. The Ontario AgRadio Network produces, syndicates and distributes daily farm market audio programming for a network of rural radio stations. Daily news items that are broadcast on radio is mirrored on Ontario AgRadio Network Internet site, together with programming schedules and broadcast frequencies across the Province. Daily farm market information (e.g. daily prices for corn, soybeans and feed) that is broadcast on the radio is available to farmers through a subscription and pay-per use system via telephone, fax, electronic mail, or regular postal mail.

Another example of collaborative information and communication partnership is the Farm Business Management Information Network - FBMInet (http://fbminet.ca). FBMINet is the result of partnerships between the Canadian Farm Business Management Council, agriculture industry players, commodity groups, farm organizations and provincial government ministries of agriculture. FBMInet provides a variety of farm management information on the World Wide Web and in print format, together with farm management software tools and an automated electronic mail delivery of market reports, news, and weather forecasts. The information on FBMInet appeals to a broad range of users, including farmers from across Canada, extension personnel, agricultural media, government agriculture specialists, university researchers, agribusiness consultants, and international users from all the above categories.

FBMINet hosts a variety of searchable databases on the World Wide Web. Each database is typically maintained by a partnership of researchers, extension personnel, government agricultural specialists and farm organizations. These databases include:

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- A collection of over 3500 Canadian agricultural research projects compiled by the Inventory of Canadian Agricultural Research Office of Agriculture and Agri-Food Canada (Federal government).
- A list of several hundred agricultural software packages in various categories, maintained by the Province of Alberta's Ministry of Agriculture, Food and Rural Development.
- Canadian Beef Cattle information including production, marketing, and more, maintained by the Ontario Cattleman's Association with support from the Province of Ontario's Ministry of Agriculture, Food and Rural Affairs. Information is provided by over a dozen organizations including the above and the University of Guelph, Beef Improvement Ontario, Beef Information Center, British Columbia Ministry of Agriculture, Fisheries and Food, Canadian Cattlemen's Association, Environmental Youth Corps, Gencor (private sector), Manitoba Agriculture, Ontario Farm Animal Council, Ontario Federation of Anglers and Hunters and Saskatchewan Agriculture.
- Canadian Dairy Cattle information including production, marketing, and more, maintained by the Canadian Dairy Extension Committee with support from the University of Guelph, and dairy experts from across Canada.
- Alberta Agricultural Research Institute Research Abstracts and On Farm Demonstration Projects, maintained by Alberta Agricultural Research Institute.
- A collection of over 1700 farm management resources from across Canada compiled by the Canadian Farm Business Management Council.

Examples of similar information, communication and learning partnerships that illustrate the power of Virtual Research and Extension Communication Networks include:

- The United States Department of Agriculture's Cooperative State Research Education and Extension Service (http://www.reeusda.gov) in partnership with university research and extension divisions across the United States, and with U.S. farmer organizations.
- AgNIC, the USDA's Agriculture Network Information Center, which is currently expanding the global reach of its web-based information network at http://www.agnic.org. The site maintains information on and links to more than 800 agricultural databases, a contact list of agricultural specialists and a calendar of agricultural conferences. In the works are on-line libraries with in-depth content and personalized assistance.
- The New Zealand Pastoral Agriculture Research Institute (http://www.agresearch.cri.nz/), a parastatal institute that collaborates with government, industry, research and farmer organizations to provide agricultural news, research information through events, print distribution, the World Wide Web and consultation services.

Agricultural stakeholders in developing countries can take advantage of the research and development of VRECNs occuring in developed countries. They may also benefit from the fact that, unlike many in the developed world, they have not made costly investments in non-networked electronic tools and thus do not feel obligations to support and maintain out-dated tools. A planned approach to stakeholder collaboration in VRECN development and strategic application of networked electronic tools could enable some developing countries to leapfrog over developed countries in terms of return-on-investment and application to critical agricultural issues.

2. Virtual Research and Extension Communication Networks and

Developing Countries

Developing countries face a growing number of agricultural development challenges. The central challenge of meeting food security goals requires collaborative, inter-disciplinary and cooperative efforts to engage stakeholders, set policy, develop research strategies, initiate programs, and provide all partners with support services, learning environments and human resource development opportunities. Similarly, increasing the incomes of poor rural residents and farmers, increasing the competitiveness of agricultural commodity production and marketing, and maintaining and enhancing the sustainable capacity of natural and genetic resource bases require interdisciplinary initiatives, cooperative dialogue and creative partnerships.

Modern information and communication technologies (ICTs) using multi-media computer links and computer tools can enhance national agricultural knowledge and information systems and benefit users in developing countries, including researchers, extension agents and farmers. "Virtual meeting places" and related mechanisms for improving the flow, sharing, and circulation of information and knowledge can help overcome many of the physical, administrative and financial challenges that hinder researchers, extension workers, farmers and other technology stakeholders from sharing knowledge, information and technical competence.

A Virtual Research and Extension Communication Network (VRECN) can allow stakeholders to engage each other to address problems and discuss solutions. It can be used to link different agricultural research experiment stations, extension offices and, where feasible, producer groups, allowing them to electronically access visual, textual and audio information. At the same time, a VRECN will promote broad participation in electronically mediated communication processes and learning activities.

Technical design, maintenance and training could be coordinated by one office within a Ministry of Agriculture. The tasks of organizing and updating the content of the network, and developing discussion and communication functions, could be a collaborative exercise among a diverse set of Ministry of Agriculture personnel and departments. The Network will thus focus attention on the necessity of collaborative linkages between personnel and departments, and will enable good managers to enhance those linkages and identify opportunities for knowledge sharing, activity partnerships and avoidance of service duplication.

The technical foundation of a Virtual Research and Extension Communication Network is a powerful networked computer database tool that enables distributed and decentralized data entry and data access in the form of text, images, audio and video. Creative marriages with other media, such as print and rural radio can extend the reach of the information resources, learning opportunities and communication processes to farmers and extension workers in rural communities.

The more important *human foundation* of a Virtual Research and Extension Communication Network is a cross-Ministry commitment to enhance collaboration, internal communication, information sharing and services to farmers and other client groups.

A Virtual Research and Extension Communication Network can be an effective way to mobilize knowledge and human resources to address food security and natural resource conservation. It has special relevance to FAO's Special Programme for Food Security, especially during the expansion phase when tested and adapted technologies will be

disseminated to potential users.

Three brief examples illustrate the value of the Virtual Research and Extension Communication Network in use in a developing country:

1. A farmer asks an extension worker for information on ways to improve her ability to market her tomato crop beyond the local village market. The extension worker visits the local Rural Extension Unit operated by the Ministry of Agriculture. Here the extension worker, with the assistance of a trained Virtual Research and Extension Communication Network user, searches the Network using keywords. The search quickly results in a list of contacts from policy, research, and extension that are experts in marketing tomatoes, as well as a bibliography of documents from each branch. Contacts can be reached by telephone, or by clicking on their names to send them email messages. The tool would also offer suggestions as to an advisory-team drawing on the different departments, and suggest past projects that have information or impact on the topic. The search would highlight a special two page "*Virtual Research and Extension Communication Network Fact-sheet*" on marketing tomatoes. This *Fact-sheet* is written specifically for farmers and extension workers and has been designed by a Virtual Research and Extension Communication Network multi-disciplinary team based on data which indicates a high demand among farmers and extension workers for information about marketing tomatoes. The Fact-sheet is based on the best available information from within the country and around the world, most of which can be found on the VRECN. Within seconds this *Fact-sheet* is printed out, complete with colour photos, contact numbers and recommendations that have been well researched and pre-tested with farmers and people involved in the marketing of tomatoes.
2. A researcher working on improving irrigation techniques realizes that a major problem facing farmers is the reliability and timing of irrigation water availability. Using the VRECN the researcher establishes an electronic discussion forum to bring together other irrigation researchers with irrigation authority experts, extension workers and representatives of farmer organizations. Their electronic discussion catalyzes a series of face-to-face workshops through which some of the technical and delivery problems are negotiated and resolved. Local rural radio stations are contacted in order for them to broadcast information on irrigation water availability to better help farmers manage their farming cycle.
3. A farmer arrives at a Rural Extension Unit carrying a leaf from one of his wheat plants. The leaf has a disease that looks like leaf rust. He explains to the village extension worker that his wheat crop is in danger due to a disease that he has never seen before. The extension worker consults the Virtual Research and Extension Communication Network via his computer and a modem connected to the Internet. After searching photographs of various diseases common to wheat, he is unable to match the insect in question with photographs of common insects. The Network prompts him to call a "Wheat Hot-line," and the wheat researcher at the other end of the phone arranges to have a photographer from the nearest Agricultural Extension Unit to photograph the insect.

> Twenty-four hours later, a team of wheat researchers at four different research stations across the country examine a digital photograph of the leaf rust disease that has been uploaded to the VRECN by the photographer. The team consults with one another during a conference call and determine that a similar form of leaf rust has been noted on the wheat crop in the Punjab. Within minutes they have accessed a photograph of this disease from a

database in the Punjab, together with specific disease management recommendations. A mere 48 hours after the disease has been identified and management recommendations confirmed, a VRECN staff member is preparing a *Fact-sheet* for immediate distribution to farmers in the affected area, and has uploaded this information to an agricultural alert bulletin on the VRECN. Rural radio stations linked to the VRECN immediately broadcast the content of the *Fact-sheet* and rapidly communicate this information to farmers across the country.

5.0 Purpose of a Virtual Research and Extension Communication Network

The purpose of a Virtual Research and Extension Communication Network is to:

Improve Communication between a Ministry of Agriculture's branches of Extension, Research and Policy by supporting:

- **Multi-stakeholder Collaboration in designing the Virtual Research and Extension Communication Network**
- **Collaborative Process and Structure for an Integrated Agricultural Knowledge System Multimedia Communication Solution that is widely accessible**

Perhaps one of the greatest benefits of a VRECN project is the ability to coordinate the type of skills and knowledge available, or required, by staff of a Ministry of Agriculture.

For example, extension workers, farmers, researchers, policy advisors, and agricultural colleges will directly benefit from an improvement in the efficiency and quality of information provided and prepared by Ministry of Agriculture staff who will have participated in developing a VRECN.

There are three subsequent impacts of establishing a planned process to create a VRECN:

1. The collaborative and consultative activities will raise awareness about the broad range of resources available to staff in Extension, Research, and Policy using traditional methods and computer-based information technology.
2. Exposure to communication and information needs assessment processes will encourage Ministry staff to support opportunities that improve facilitation, communication and information sharing as well as increase the adoption of information technology.
3. The cross-Ministry nature of the process of developing a VRECN will enhance partnerships and collaboration among Ministry Staff to collect, qualify and organise information using a user-friendly information technology product.

These awareness and process impacts are just as important (perhaps more important) as the creation of the Virtual Research and Extension Communication Network tools. Developing a VRECN requires balancing the collaborative design process of creating the VRECN with the VRECN itself. The "face-to-face" collaborative design process will help map the existing agricultural knowledge and information system within a country, and it will help lay the foundation for collaboration and information sharing necessary for the tools of the VRECN to achieve results.

6.0 Rationale for a Virtual Research and Extension Communication Network in a Developing Country

The agricultural research and extension systems in developing countries are facing unprecedented challenges and opportunities. These challenges and opportunities include:

- Processes of decentralization,
- A rapidly developing market-based agricultural systems
- Land reform issues,
- Environmental protection imperatives,
- Rural population and urban migration issues,
- Changing gender roles and relationships in agricultural production
- Decreasing government resources,
- Civil service reform,
- Pressing water resource management issues,
- Global trade liberalization,
- Export quality standards.

Many developing country Ministries of Agriculture are in the process of adapting their policies and programs to help respond effectively to the food security and agricultural production needs of their countries, but the task is immense.

More and more, knowledge and information are becoming critical agricultural input. Perhaps the key agricultural inputs of the 21st Century are:

- accurate, reliable and timely information and knowledge;
- efficient and effective communication mechanisms with which to share knowledge and information.

The resource poor farmer, the village extension worker, the researchers at agricultural research stations, and the policy-makers at the Ministry of Agriculture are all responsible for making decisions that affect a country's ability to meet its food security and agricultural production needs. They all need access to information. They all need opportunities to develop their knowledge resources. And they all need access to the means to communicate and share knowledge and information.

Meeting challenges and maximizing opportunities requires optimal knowledge and information sharing throughout the agricultural research and extension systems: horizontally among line agencies and vertically from the farmer to the Minister. Meeting challenges and maximizing opportunities also requires an orientation to collaborative problem solving and inter-organizational learning. However, an orientation to collaborative problem solving and inter-organizational learning is rare among government bodies throughout the world.

Competition for scarce budgetary allotments, personal priorities for career advancement, salaries and benefits, and rivalries between government agencies can mitigate against the adoption of such an orientation to collaborative problem solving and inter-organizational learning. The pressure to hoard knowledge and information can often be stronger than the imperative to share.

Creative measures and strong *champions of knowledge and information sharing* are required, and *champions* need access to appropriate communication and information tools to advance their goals.

There are strong *champions* of knowledge and information sharing within the most Ministries of Agriculture and throughout national agricultural systems. They exist at all levels, and their common characteristic is a desire to serve their country, meet the challenges it faces and maximize the opportunities it has available. Any effort to develop the appropriate communication and information sharing tools required to advance knowledge and enhance decision-making *must* begin with these *champions*. Establishing a VRECN provides spin-off opportunities to identify and support these champions.

7.0 Description of a Planned Process for Creating a VRECN in

a Developing Country

Creating a VRECN in a developing country requires a planned process of stakeholder engagement, multi-stakeholder assessments of communication and information needs, and collaborative workshops to determine the desired characteristics of a VRECN, together with management relationships, and development partnerships. Early in the process, stakeholders need to accurately and honestly assess the quality of existing communication patterns and existing information technology products and processes. Stakeholders need to go beyond classification of information by department, and identify the unique challenges facing Ministry staff in different departments and/or stakeholders across the country who have limited access to information resources.

Key VRECN Stakeholder engagement processes include:

- A national workshop among key Ministry of Agriculture stakeholders to build stakeholder ownership of the project, map existing information and knowledge sharing mechanisms, and generate recommendations for strengthening and enhancing those mechanisms with computer-based tools and a Virtual Research and Extension Communication Network .

- Regional and subject-matter specific (e.g. a strategic agricultural commodity) workshops will identify key Virtual Research and Extension Communication Network functions and operational characteristics.

- Participatory rural and agricultural appraisals at the field level to insure that the Virtual Research and Extension Communication Network is accurately focused on the information and knowledge needs of the broader agricultural community. Techniques will include stakeholder focus groups, interviews, and guided brainstorming discussions.

These stakeholder engagement processes will help potential users recognize that the value of electronic networking tools lies directly in their ability to enhance relationships among people. There is a tendency to fetishize computer-based tools and expect them to somehow solve human problems using computer chips and alone. The tools are only as powerful as the determination of users to strengthen and enhance their communicative and information sharing relationships in order to better solve problems and address issues collaboratively.

Stakeholder engagement processes can help highlight the fundamental power of communication and information sharing in agricultural development.

Throughout these stakeholder engagement processes, attention must be paid to the involvement of stakeholders who might otherwise be marginalized. Specifically, this means that women, resource poor farmers and other stakeholders who are often absent from decision-making in agricultural systems, must be brought into the VRECN development process. Not to do so means that the VRECN will simply reinforce tendencies to marginalize such stakeholders, and the system itself will not reflect the priorities of gender integration or agricultural development that benefits resource poor farmers. Some technocrats and bureaucrats may be uncomfortable with the involvement of marginalized stakeholders, and insuring their involvement requires delicacy and creativeness in finding appropriate means and venues for securing their participation.

The benefits of the participation of marginalized stakeholders, in terms of the efficacy and application of a VRECN to meeting national agricultural development goals, are clear. The involvement of women, for example, in establishing some electronic networks for rural and agricultural development in Canada has helped insure that the tools remain grounded in practical circumstances. All male teams of computer experts charged with developing computer-based tools can often get carried away with technical wizardry and lose sight of the basic purpose of the tools they are developing. Diverse stakeholder involvement is a key factor in "keeping things real" during the development process.

7.1 Objectives of a Planned Process for Creating a VRECN in a Developing Country

A Virtual Research and Extension Communication Network will provide high quality information and services for research staff of a Ministry of Agriculture in a developing country. Investing in the planned process for creating a VRECN will further develop the human capital and increase the potential value that research and extension services can add to the economy in the agriculture sector.

The specific objectives of a planned process for creating a VRECN are:

    1. To build a central clearinghouse of agricultural research Information that includes:

- Ministry personnel and agencies with agricultural knowledge (broken down by region and job description)
- Agricultural research resource library (broken down by region, resource type and contact person)
- Statistical monitor of activity and usage.

    2. To measure the level of information technology access and use among Ministry staff and to document the specific uses of information technology among staff, and any gaps that might exist between what is available for finding information, what is needed, and making qualified recommendations.

    3. To identify the barriers (if any) related to access to, training needs and use of information technology among Ministry staff.

    4. To involve a variety of stakeholders, including farmer organizations, in the process of creating the VRECN in order to provide insure practical applications, distributed information input and multi-stakeholder communicative and problem-solving relationships.

These objectives are specific, detailed, and measurable.

A planned process for creating a VRECN will generate tools that may be suitable for individual use or as part of an online Internet service through Ministry programs that would provide all staff, and external agricultural stakeholders, with the wealth of information and expertise available to them. While the VRECN will be oriented to Internet technical protocols, many potential users will not have access to the Internet at present. Material could be accessible through CD-ROM and/or as a diskette installation, using simple but effective graphics to guide staff members and stakeholders. As Internet access expands, existing and future Internet users will play key roles in managing and updating material.

7.2 Contribution to Knowledge

The results of this Virtual Research and Extension Communication Network are important because they directly relate to existing mandates of the many departments of a Ministry of Agriculture, and how the relationships between those departments and agricultural research occurring around the world.

There are an infinite number of electronic, telecommunication and computer-based tools that can be applied to communication and information sharing, or knowledge generation and learning. At the same time, there is increasing pressure to adopt some of these tools simply because it is the thing to do: not because there is a demonstrated need or a proven value. We buy an irrigation pump because we need to irrigate crops to produce food. We do not buy an irrigation pump to produce fodder for livestock or harvest maize. Many of the tools used to manage agricultural systems have self-evident uses and are utilized by people who have made very careful choices about cost and benefit. Electronic, telecommunication and computer-based tools can have very beneficial uses in the management of agricultural systems. However, there is a marked tendency for us to neglect the decision-making care and the weighing of costs and benefits that we would normally apply to choices in fertilizer or farm equipment.

The attraction of new electronic, telecommunication and computer-based tools, or as they are known in technical jargon, ICTs (information and communication technologies), is powerful. The world of agriculture, like many other fields, is littered with expensive ICTs that were poorly chosen, are under-utilized or are gathering dust. As a Ministry of Agriculture in a developing country considers the adoption of ICTs within the contexts of "Agricultural Modernization," "Agricultural Policy Reform," "Decentralization" and "Responsiveness to Agricultural Stakeholders," it faces pressure to adopt ICTs quickly and without due diligence. It also faces pressure to adopt ICTs that have worked in the contexts of another country, but which may be unsuitable to indigenous contexts.

There is little question that the adoption of ICTs will happen in many developing countries, and that the benefits of their use *might* contribute to meeting the challenges and maximizing the opportunities faced by agricultural stakeholders. To insure that ICTs *actually* contribute requires due diligence to accurately assessing information and communication needs, and to assessing current information and communication processes to discover which are working and which are deficient in meeting stakeholder needs. Before ICT adoption occurs, and before ICT information and communication user applications are developed, good managers will

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spend the time necessary to make cost effective and appropriate choices.

The field of "communication for development" provides some of the strategies and tactics for conducting information and communication needs assessments and related assessments of current and desired communication and information sharing patterns. The strategies and tactics are surprisingly simple, but do require resources and a certain amount of time. Strategies include planning for multi-stakeholder workshops, participatory rural and agricultural appraisals at the field level, and participatory appraisals among the people enmeshed in existing formal and informal communication patterns within services for agricultural improvement such as research and extension. Tactics include the use of stakeholder focus groups, interviews, guided brainstorming discussions, designed to gather input and brainstorm about desired information and communication patterns, and the use of ICTs that respond directly to the communication and information needs of stakeholders.

The marriage of "communication for development" and ICTs is relatively new. The documentation of experiences and lessons-learned on this project will prove extremely valuable to others seeking to marry "communication for development with ICT tool development.

7.3 Benefits of a VRECN over other Media

Traditional marketing and extension of any agricultural information or research program simply provides a snapshot of information that is current only at the time of publication. Communication tools, based on electronic media can provide information opportunities that have not been available for marketing and extension of information in the past. In addition to the "broadcasting" of relevant information the Internet is capable of delivering current information in a more time critical fashion than any other media before it.

Web site statistics will represent an important measure of the volume of use that the Virtual Research and Extension Communication Network will receive. These statistics will provide important information and will determine what type of information is of interest to the Ministry staff based on the number of requests for information from to the various departments, topic headings and documents available on the site. The information database can be modified to allow content use to be tracked by key criteria.

The author has been involved with several electronic media programs that have been initiated to assist in the transfer of information in the agricultural sector including; Canada's Agrifood Directory (www.caffeine.ca), Food Biotech Communications Network (www.foodbiotech.org), Canadian Agri-Food Marketplace (www.canadianfood.com) and the International Development Studies Network (www.idsnet.org). These experiences provide some valuable "lessons-learned."

The growth in use of the electronic media and communication by such means has been unsurpassed. Users are coming on line in unprecedented numbers as the benefits of this type of communication link are realized by increasing numbers of people, organizations, and industry. For instance, in North America, the Government of Canada wants to make the Information Highway accessible to all Canadians by the year 2000. Industry Canada's Community Access program, which is a $30 million program, will link 5,000 urban and 5,000 rural/remote communities to the Information Highway by the 2000-2001 fiscal year.

(http://cnet.unb.ca/cap/)

North American society in general has accepted electronic media as an important source of information and an important means of communication. Applied research undertaken by the author documents a number of new electronic media applications in developing countries. Uptake of electronic media in agriculture is especially strong in Latin America, and it is only a matter of time before these media become commonplace in other regions of the world. Efforts to pilot electronic media activities today will help decision-makers in developing countries to make more informed investments in these tools in the future.

7.4 Experiential and Collaborative Learning through VRECN Tools

Electronic media have also proven their value as experiential learning tools (see Appendix 2 for some examples). They can be used to accelerate learning when used as communication tools in networked, large group settings. They are commonly used to address serious business issues such as mergers, acquisitions, company direction, vision and change. Rooted in the computer world of "adventure games," electronic experiential and collaborative learning tools are powerful learning catalysts.

Electronic experiential and collaborative learning tools are commonly found in fields such as medicine and engineering, but can also be found in fields such as agriculture, ecology and land use planning (e.g. Sim-Farm and Sim-Isle, which simulate the complexities of farming and ecosystem health, respectively). These learning tools take advantage of the power of computers to simulate realistic situations that adult learners might find themselves facing in their working lives. Complex decision-making alternatives, instantaneous feedback on decision choices, and experiences that include visual and audio cues enable adult learners to face situations that might only happen once in a career.

Used in a collaborative learning context (either electronically networked or face-to-face), these learning tools provide opportunities for in-depth discussion of practice issues, alternate choices, ethical dilemmas, and strategy. At the same time, learners strengthen their ability to work with peers collaboratively, sharing ideas, lessons learned in practice, and knowledge, and gaining more experience with team decision-making. Many of these learning tools place teams of adult learners in situations where they must make life and death decisions in very realistic contexts, but the risks of their decisions are played out on computer screens and not in hospital wards or ecosystems.

Existing training programs with the Ministries of Agriculture in developing countries will take on a whole new flavor with the addition of electronic experiential learning tools. Such creative programs address why behavior affects results, rather than just how. By helping people experience and understand why certain behaviors produce specific results, it brings relevance to the learning. Relevance makes the learning memorable, increases retention and motivates changed behavior. Ultimately, this positively impacts results on the job.

Designing a customize Ministry of Agriculture learning tools, based on a collaborative experiential learning model, will place participants in a structured and realistic set of circumstances. The visually interesting and dynamic circumstances will reflect the situations that researchers, extension workers and farmers face everyday. Participants will receive maximum learning in less time through the use of imagery, intricate themes, excitement and

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fun. Fun and excitement help ensure that participants will be motivated to continue using the learning tool to learn. Debriefing sessions will encourage users to relate their virtual learning with their day-to-day work and the benefits of collaboration and information sharing.

The process of designing such learning tools provides an opportunity for a learning intervention in and of itself. In order to capture the complexity of an agricultural system, and the wide variety of decisions, outcomes and player relationships possible within that system, designers must undertake a thorough qualitative study with stakeholders throughout the agricultural system. To be effective, the learning tool must present learners with experiences that truly simulate the reality of the world in which they work – with all its blemishes, humour, and colour.

Experiential and collaborative electronic learning tools are a useful addition to the suite of tools available through a VRECN. Their development is, however, time consuming and costly and VRECN adopters are wise to consider ways of using existing learning tools that can be adapted to local agricultural system management issues (see Appendix 2).

7.5 Target Stakeholders for a Planned Process for Creating a VRECN

The target stakeholders for a planned process for creating a VRECN in a developing country consist of those Ministry staff who will participate in the project itself, and those who will benefit from the results of VRECN use. This includes, but is not limited to, members of Agricultural Research Centres, staff of field research offices, university researchers and extension specialists in various fields of agriculture, distributed at village, district and provincial levels.

Participants

Ministry Staff. The participants in the project will be from the national Ministry of Agriculture, representing the Ministry's core functions of Research, Extension, and Policy.

Advisory Committee. Formation of an advisory committee comprised of influential people with expertise in various disciplines will provide input for a collaborative effort of the many organizations working with Ministry Staff. This committee will advise and direct the project and review periodic reports prepared by the project manager. To insure relevance of the Virtual Research and Extension Communication Network , the Advisory Committee will include, but not be limited to, Ministry clients such as farmer representatives, representatives of agricultural business, and decision-makers within the extension system.

Beneficiaries

Farmers and Agricultural Businesses. As a direct result of VRECN use, any request for information from Ministry staff will directly or indirectly draw from an information technology resource, and collaborative communication process. Long term, the extension, research and policy branches will benefit from an improved environment of increased quality and utility among information technology products and services.

Agricultural and agri-food stakeholders. This Virtual Research and Extension

Communication Network will directly benefit stakeholders by identifying how Ministry Staff are actively seeking information via information technology, and for what purposes technology is being used. This information will be invaluable in helping to direct information management activities in the short to medium term. The information revealed from the site activity statistics will be the first comprehensive set of statistics that will describe how Ministry Staff are using information technology to collect and qualify agricultural information and resources.

Results of this project will highlight particular needs of the national Ministry of Agriculture staff. For example, it may identify communication infrastructure and training needs. Ongoing discussions between ministry staff will provide opportunities to better identify and address any gaps and needs that would provide a direct benefit to Ministry staff in particular, and the national agriculture community in general.

7.6 Action Plan and Time Frame

The planning phase for developing a VRECN requires a minimum of one year, and will need to evolve in parallel with national agricultural seasons and work patterns. During the planning phase, a team is created to drive the development of the VRECN and to manage stakeholder input processes and the critical communication and information needs assessments among stakeholders. This the time period would also be used to review all relevant materials, surveys, existing data, correspondence and participation submissions. Activities will include stakeholder workshops, development of the VRECN concept, storyboard and model, assessment of technical options and costs, project reporting, evaluation, and procurement of additional funding for creating the Virtual Research and Extension Communication Network and monitoring and evaluating its use.

Listed below are details of the steps involved. Included is a time line to show the progression and linkage of activities.

> ### *Step 1* Project Preparation, Information Technology Assessment, and Virtual Research and Extension Communication Network Prototype Development (8 weeks)

Partners of the Virtual Research and Extension Communication Network will work as a team to search in detail the range of existing information technology products and services available to Ministry Staff. A national workshop among key Ministry of Agriculture Stakeholders will help launch the Project and facilitate the assessment and Virtual Research and Extension Communication Network prototype. Stakeholders will participate in detailed communication and information needs assessments that map out existing communicative relationships and highlight relationships and processes that can be enhanced to improve agricultural development.

> ### *Step 2* Identify Product and Services for Virtual Research and Extension Communication Network in India (2 weeks)

Partners of the Virtual Research and Extension Communication Network will promote the use of the site on their existing newsletters and participation in meeting or seminars. It is expected that the news of the network will spread by word of mouth and online activities. A contact list of supporters and interested participants in the Virtual Research and Extension Communication Network will be created and to be used to identify workshop participants and to collect feedback for interim and final reports.

Step 3 Create Virtual Research and Extension Communication Network Prototype and Directory (18 weeks)

Develop a fully functional database driven Virtual Research and Extension Communication Network that develops a number of tangible products, including: Experiential and Collaborative Learning Tool and Agricultural Resources Directory.

Step 4 Evaluation of Product and Services (5 weeks)

Once the Virtual Research and Extension Communication Network prototype has been operating for the 2 months, information will be collected from participants for reviewed and discussion. Regional and subject-matter specific workshops will assist in refining the content and operational characteristics of the Virtual Research and Extension Communication Network. Field-level participatory rural and agricultural appraisals will test the relevance of the content and operational characteristics of the Virtual Research and Extension Communication Network from the point-of-view of farmers and extension workers. Results will be analyzed and summarized in report form for a final report.

Step 5 Identify and Secure Support from staff (3 weeks)

Throughout the project, support will be sought form the participating staff. Measuring the support from staff will demonstrate the value of collaboration and identify ways to overcome barriers for other staff to access and use of such online resources. This will help to determine future directions for professional development using information technology.

Step 6 Project Evaluation (2 weeks)

Building on information generated through surveys, evaluations, site usage statistics, and a final report including a recommended strategy to increase access and use of information technology for the Ministry of Agriculture.

Proposed Timetable

Project Duration: 12 months

Starting: January, 1999 (hypothetical)

Ending: January, 2000

Month	1	2	3	4	5	6	7	8	9	10	11	12
Project preparation/meeting	****	****										
Identify Products/Services	**											
Create and Maintain Network	****	****	*	*	*	*	*	*	*	*	*	*
Evaluation of Products/Services							**	****				
Identify and secure Sponsorship			*		*		*		*		*	
Project Evaluation												**

Note that "**" indicates the duration in weeks of the various activities, but do not necessarily reflect consecutive days of work.

8.0 Products and Deliverables

A number of tangible products will result from a planned process for creating a VRECN, particularly through efforts to establish stakeholder needs assessments and collaborative working groups. These products include:

1. Straightforward Internet communication and info/knowledge sharing network with easy access to:

- Indigenous language email tools,
- Indigenous language web databases for user input of reports,
- Existing agricultural studies and research,
- Existing agricultural extension recommendations,
- Existing extension information targeted to farmers and extension workers,
- A phone/address directory for the Ministry by person, subject, location.

1. Knowledge of national Agricultural Information and Knowledge Systems and Needs, including:

- Results from national, regional and subject-matter workshops
- Results from stakeholder information & communication needs assessments,
- Results from pre-testing and refining the Virtual Research and Extension Communication Network.

1. Greater stakeholder activity surrounding the use of electronic information and communication technologies for agriculture, including:

- A diverse set of ICT trained Ministry staff as a result of decentralized computer/Internet

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training,

- Solid participation of stakeholders such as farmer organizations, telecommunication authorities, agricultural research centres, extension offices, etc.

1. A working combination of indigenous language web/email tools and a developing CDROM resource which can eventually become a kind of encyclopaedia of the Ministry of Agriculture. The evolution of this resource will build on the project's initiation and support for information and knowledge sharing among all relevant units of the Ministry of Agriculture.
2. A strengthened working culture that supports and rewards information and knowledge sharing. The participating units within the Ministry of Agriculture will that they have more value by sharing information and knowledge rather than not sharing. The Virtual Research and Extension Communication Network will be a functional tool in helping them to collaborate (i.e. the CDROM resource could be used to look up a topic like "rice export." The results of the search would yield a list of contacts from policy, research, and extension that are experts in the topic, as well as a bibliography of documents from each branch. The tool would also offer suggestions as to a work-team drawing on the different departments, and suggest past projects that have info or impact on the topic).
3. The above together with an educational and entertaining experiential and collaborative learning tool that mimics current and more satisfactory collaborative behaviour within the Ministry, extension and research. This could be on-line as a group activity, as well as on a floppy disk or CD-ROM for individual use. It will be based on computer role-playing games that have been successfully adapted to enhancing learning in practical work contexts (see Appendix 2). Activities will begin with a user taking the role of someone working as a junior research staff member in the Ministry. The user is presented with "quests" or tasks that must be undertaken, and there is no specific correct solution, simply better and worse solutions. If they communicate within their branch as well as with other branches, and/or undertake visits to field research stations, universities and extension field offices, it might take a little more time, but a better solution is found and they are promoted from junior research staff to a higher level. While engaged with this learning tool, the user is informed of the results of their efforts. They gain feedback in at least three ways: personally for themselves (they gather a group of confidants and friends + promotion); for their branch (because they were successful the research branch achieves targeted objectives) and; holistically on the impact on the broader agricultural environment of the nation (GDP, exports, etc.). This will give users the big picture of the agricultural system and the value of everyone's role in it.

7) A survey tool that can be used again in the future to determine changing rates of access and usage of information technology, or to be used in other geographic locations.

- Site access statistics will provide an indication that measure the degree of access and use of information within and beyond the Ministry
- This will serve as a benchmark to compare growth in the future use of information technology within and beyond the Ministry.

8. A final report that can be used by government, academia, and the private sector to improve access and utility of information technology in support of agricultural and rural development.
9. Quantitative and qualitative information that can be used to develop research and extension strategies for the rural community and agricultural sector, both regionally and internationally. This will be of particular value for feasibility studies regarding the

development of eventual phases II and III of this Project.

9.0 Evaluation Plan

A planned process for developing a VRECN within a developing country will also involve the collection of very specific and detailed information through VRECN activity statistics, surveys, evaluations, workshops and online feedback from participants and participating. These will serve as information sources to evaluate the success of the project.

The achievement of each VRECN objective can be measured by various outcomes of the process:

1. To measure the level of information and communication technology access and use among Ministry Staff.

Records will show accurately how online products and services were used.

2. To document the specific uses of information technology among Ministry Departments and any gaps that might exist between what is available for making informed decisions and what is needed.

Records will show accurately how information technology products and services are being used and the gaps that might exist.

3. To evaluate and assess the quality, utility, and appropriateness of existing information resources and communication structures for Ministry staff.

Surveys will identify and record staff perceptions about the quality, utility, and appropriateness of products and services.

4. To identify the barriers (if any) related to access to and use of information technology among Ministry Staff.

Feedback in the evaluation stage, as well as from workshops, discussion forums, and participatory rural and agricultural appraisals at the field level, will identify barriers.

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